

Application No. 10/643,043
Docket No. DP-308286
Amendment dated October 20, 2005
Reply to Advisory Action of October 3, 2005

REMARKS

In an Office Action filed July 27, 2005 (Paper No. 20050505), claims 1 and 3-20 of the above-identified US Patent Application were said to be rejected under 35 USC §103. However, only claims 1, 3-7, 10-16, and 18-20 were pending at that time. Amendments to the specification and claims that were submitted in a response filed September 27, 2005, were refused entry.

With this Submission, Applicants are amending the specification and claims as set forth above. More particularly:

The specification has been amended at paragraph [0011] to correct a typographical error.

Independent claim 1 has been amended to incorporate the limitation of its dependent claim 6, and independent claim 13 has been amended to reinstate a limitation previously canceled therefrom, namely, a thermally-conductive lubricant means is not present between the second surface of the device and the heat-conductive member.

In view of its limitation being incorporated into its parent claim 1, dependent claim 6 has been amended to recite a limitation found in paragraph [0018] of the specification. Independent claim 13 has been similarly amended to incorporate the same limitation.

Dependent claim 7 and independent claim 13 have been amended to correct an error, namely, the structural adhesive is now recited to have "a cure

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temperature approximately equal to the melting temperature of indium" (emphasis added), instead of "a cure temperature approximately equal to indium," the latter of which incorrectly states that indium has a cure temperature.

Applicants believe that the above amendments do not present new matter. Favorable reconsideration and allowance of claims 1, 3-7, 10-16, and 18-20 are respectfully requested in view of the above amendments and the following remarks.

Rejection under 35 USC §103

Independent claim 1, its dependent claims 3-7 and 10-12, independent claim 13, and its dependent 14-16 and 18-20 were rejected under 35 USC §103 as being unpatentable over U.S. Patent Application Publication No. 2003/0150635 to Smith. Smith cites priority back to the same priority document as U.S. Patent No. 6,238,938 to Smith, cited in the first Office Action and withdrawn as a reference in the second Office Action filed in this application.

Applicants respectfully request reconsideration of this rejection in view of the following comments.

Applicants' independent claim 1 recites an electronic assembly (10) that requires:

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a housing member (20) comprising a heat-conductive member (20,26);
a substrate (14) supported by the housing member (20);
a circuit device (12) mounted to the substrate (14);
a solid solder joint (30) bonding the device (12) to the heat-conductive member (20,26) and consisting essentially of an indium preform into which one or more alloying constituents have diffused to increase the melting temperature of the solder joint (30) above that of the indium preform; and
an overmold compound (32) that encapsulates the substrate (14), the device (12), and the solder joint (30), and has a cure temperature approximately equal to the melting temperature of indium but less than the melting temperature of the solder joint (30) so as to enable curing of the overmold compound (32) without adversely affecting the bond formed by the solder joint (30) between the device (12) and the heat-conductive member (20,26);
wherein a thermally-conductive lubricant means is not present between the second surface of the device and the heat-conductive member.

Applicants' independent claim 13 recites an electronic assembly (110) that requires:

a housing (20) comprising a pedestal (26);
a substrate (14) supported by the housing (20);
a circuit device (12) mounted to the substrate (14);
a solid solder joint (30) bonding the device (12) to the heat-conductive member (20,26) and consisting essentially of an indium preform into which one or more alloying constituents have diffused to increase the melting temperature of the solder joint (30) above that of the indium preform; and
a structural adhesive (24) bonding the substrate (14) to the housing (20) and having a cure temperature approximately equal to the melting temperature of indium but less than the melting temperature of the solder joint (30) so as to enable simultaneous curing of the structural adhesive (24) and diffusion of the at least one alloy constituent into the indium preform;
wherein a thermally-conductive lubricant means is not present

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between the second surface of the device and the heat-conductive member.

Applicants believe that Smith does not disclose or suggest the following limitations found in Applicants' claims:

- (1) The solder joint (30) is formed by an indium preform into which alloying constituents have been diffused (independent claims 1 and 13);
- (2) The overmold compound (32) encapsulating the solder joint (30) has a cure temperature approximately equal to the melting temperature of indium but less than the melting temperature of the solder joint (30) (independent claim 1);
- (3) The structural adhesive (24) has a cure temperature approximately equal to the melting temperature of indium but less than the melting temperature of the solder joint (30); and
- (4) A thermally-conductive lubricant means is not present between the second surface (28) of the device (12) and the heat-conductive member (26).

Though pointed out in Applicants' remarks presented with each of their previous responses, the first three of these differences have neither been acknowledged nor disputed in any of the Office Actions of record. If the Examiner's position is that the first three limitations outlined above are merely

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process-related and therefore do not provide limitations to Applicants' claimed electronic assembly, Applicants must respectfully disagree. According to MPEP §2113:

The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "Interbonded by Interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.)

Within materials, diffusion is a process that occurs as a result of a compositional gradient. In the case of "a solid solder joint (30) . . . consisting essentially of an indium preform into which one or more alloying constituents have diffused to increase the melting temperature of the solder joint (30) above that of the indium preform," some degree of a compositional gradient exists because "the solder joint solidifies as the alloying constituent diffuses into the solder joint" (Paragraph [0009]; emphasis added). Therefore, the "diffusion" limitation of claims 1 and 13 is not merely process-related, but instead is a compositional limitation of the solder joint 30 that can be observed by chemical analysis of the solder joint 30.

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Melting and curing temperatures are physical and chemical properties of matter. Therefore, the melting temperature of the solder joint (30) and the cure temperatures of the overmold compound (32) and structural adhesive (24) are not merely process-related, but instead are compositional limitations to the types of materials that can be used for the solder joint (30), overmold compound (32), and structural adhesive (24).

Because Smith lacks any disclosure or suggestion of the first three limitations set forth above, Applicants respectfully believe that the maintenance of these rejections under 35 USC §103 was improper, particularly since the Examiner has never rebutted them.

Finally, Smith requires that both sets of "thermally conductive masses" 1550a and 1550b (which may be formed of a fusible material such as an indium alloy) are molten during processing and operation of the assembly so that

The only mechanical interconnection between the chips 1524 and the flexible, dielectric sheet 1512, and hence the only mechanical interconnection between the chips 1524 and substrate 1538, is provided by the compliant layer [1556]. . . . Similarly, the thermally conductive masses 1550b . . . provide a highly conductive but highly compliant flexible thermal pathway between the chips 1524 and the heat sink 1542.

Smith at paragraph [0104]

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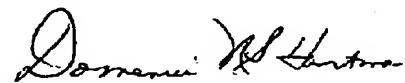
In other words, Smith requires the presence of a thermally conductive lubricant means in the form of molten thermally conductive masses 1550a and 1550b located on both sides of the chips 1524. Therefore, Smith also lacks any disclosure or suggestion for the fourth limitation set forth above, and Applicants respectfully request withdrawal of the rejections under 35 USC §103.

Closing

In view of the above, Applicants respectfully request that their patent application be given favorable consideration.

Should the Examiner have any questions with respect to any matter now of record, Applicants' representative may be reached at (219) 462-4999.

Respectfully submitted,

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